

THE COMPOSITION OF COMETARY SILICATES

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Based on infrared spectra of emission features in the 10 and 20 micron spectral regions, silicates in comets appear to be a mix of crystalline enstatite and forsterite plus glassy or amorphous grains of olivine and pyroxene composition. This heterogeneous mixture of high and low-temperature condensates is consistent with the composition of anhydrous, chondritic aggregate interplanetary dust particles of likely cometary origin.

Comets are thought to have formed in the outer regions of the solar nebula where the temperatures remained cold enough so that unaltered interstellar grains could have been incorporated into the accreting comet nuclei. The glassy silicate grains may indeed be interstellar grains. The origin of the crystalline silicates is not clear. If they formed in the hot inner solar nebula, then their presence in comets requires extensive mixing in the solar nebula. If they are pre-solar, then one has to understand why the spectral signature of crystalline grains is absent in the spectra of young stellar objects, except in a few late-stage objects where a cloud of comets may already be present.